

Revision of *Microplasma parallelum* Etheridge, 1899 (Cnidaria: Rugosa) from the Middle Devonian Moore Creek Limestone of New South Wales

YONG YI ZHEN

Palaeontology Section, The Australian Museum, 6 College Street, Sydney NSW 2010, Australia
(yongyi.zhen@austmus.gov.au)

Zhen, Y.Y. (2007). Revision of *Microplasma parallelum* Etheridge, 1899 (Cnidaria: Rugosa) from the Middle Devonian Moore Creek Limestone of New South Wales. *Proceedings of the Linnean Society of New South Wales* **128**, 201-208.

The holotype and sole known specimen of the rugosan coral *Microplasma parallelum* Etheridge, 1899 is reassessed. This phaceloid species with only sporadic occurrence of isolated dissepiments or presepiments is here selected as type species of the new subgenus *Loyolophyllum* (*Fasciloyolophyllum*), which is erected to accommodate phaceloid species otherwise resembling *Loyolophyllum* (*Loyolophyllum*). Two other species previously referred to *Fasciphyllum*, from the Devonian of China, are also ascribed to this new subgenus. Review of the concept of *Loyolophyllum sensu stricto* leads to a reappraisal of those species assigned to it.

Manuscript received 25 August 2006, accepted for publication 13 December 2006.

KEYWORDS: Devonian, *Loyolophyllum*, Moore Creek Limestone, Rugose corals.

INTRODUCTION

Microplasma parallelum is a poorly understood rugose coral of Middle Devonian age, known only from the holotype collected from the Moore Creek Limestone (late Eifelian to early Givetian), near Tamworth in the New England Fold Belt of northeastern New South Wales (Fig. 1). The first (and only) description of this specimen was made more than one hundred years ago by Etheridge (1899). Fletcher (1971), Hill (1978), and Pickett (2002) all maintained Etheridge's assignment of the species to *Microplasma*, although Pedder (1967) listed it as "*Microplasma*" *parallelum*". Redescription of the type material, including the original partially silicified specimen and two thin sections illustrated by Etheridge (1899), is here supplemented by eleven additional sections which reveal new morphological details supporting relocation of *Microplasma parallelum* to a new subgenus *Loyolophyllum* (*Fasciloyolophyllum*). Two other species referable to this subgenus are recognised from the Early and Middle Devonian of China. Emendation of the concept of *Loyolophyllum sensu stricto* leads to a reappraisal of those species attributed to it globally; four (possibly six) species

are included, but a further four previously assigned to *Loyolophyllum* can now be placed in other genera.

TYPE AREA AND BIOSTRATIGRAPHY

Some 19 species of rugose and tabulate corals described by Etheridge (1899) from several limestone localities to the north of Tamworth (Fig. 1) were mostly collected by Prof. T.W. Edgeworth David and the New South Wales Government Geologist, Mr. E.F. Pittman. The holotype of *Microplasma parallelum* was collected by David from the Moore Creek Limestone exposed immediately south of Moore Creek (Fig. 1; see Etheridge 1899, p. 161). This area has been taken as the type locality of the Moore Creek Limestone Member of the Yarrimie Formation (Brown 1942, Crook 1961, Mawson et al. 1997, Brühl and Pohler 1997). From this locality two other rugose coral species, *Disphyllum robustum* (Etheridge, 1899) and *Australophyllum giganteum* (Etheridge, 1899), four species of tabulate corals, including *Favosites goldfussi* d'Orbigny, 1850, *Thamnopora crumneri* (Etheridge, 1899), *Syringopora auloporoides* Etheridge, 1899, and *Remesia porteri* (Etheridge,

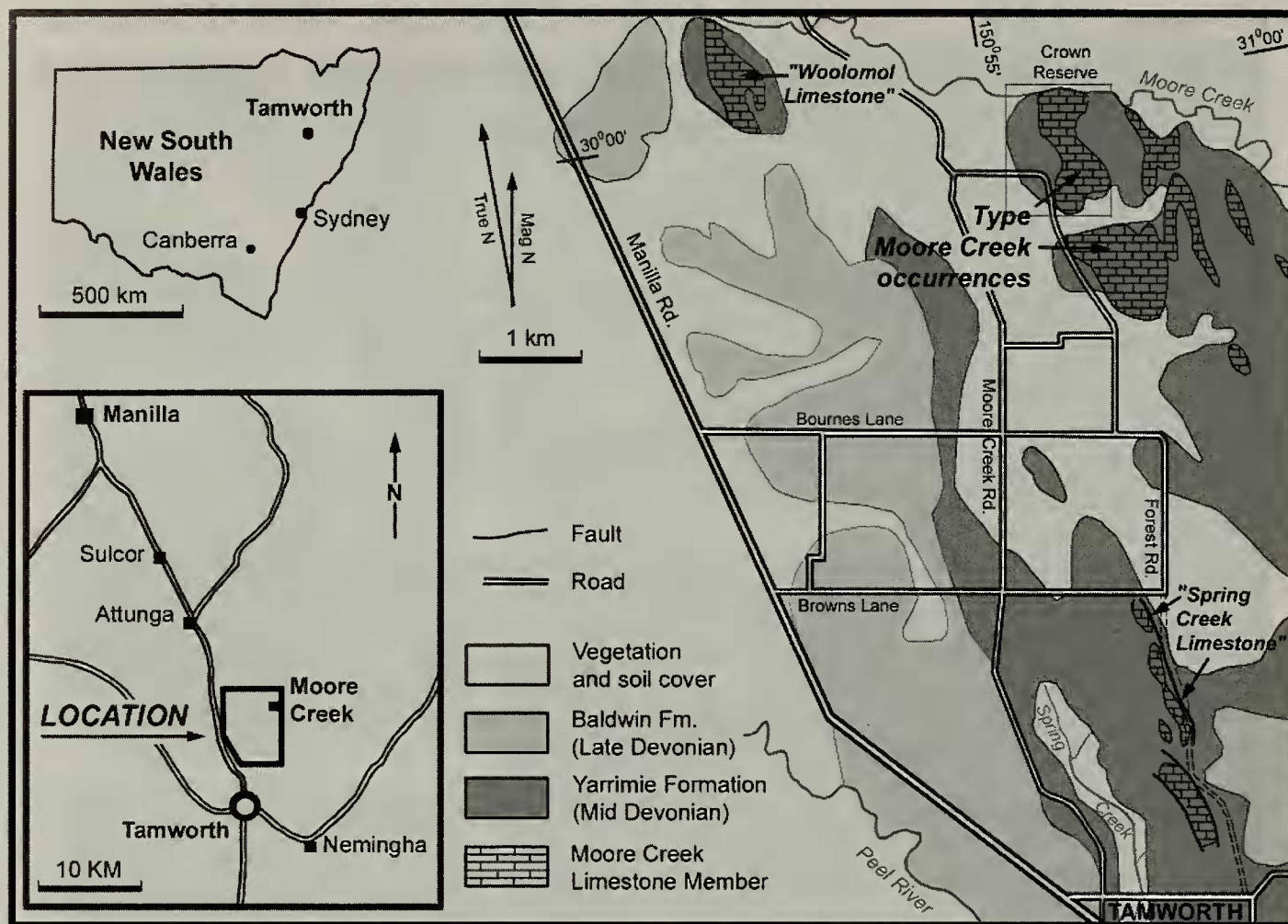


Figure 1. Locality map showing outcrops of Moore Creek Limestone in the vicinity of Tamworth (type Moore Creek occurrences are located about 18 km north of Tamworth city centre), northeast New South Wales, and likely type locality of *Loyolophyllum* (*Fasciloyolophyllum*) *parallelum* (Etheridge, 1899) (modified after Benson 1915, Brühl and Pohler 1999).

1899), and a chaetetid species, *Litophyllum konincki* Etheridge and Foord, 1884, were also recorded by Etheridge (1899), who inferred the coral fauna to be of Early Palaeozoic age.

Hill (1942) reported a much more diverse rugose coral fauna from the Moore Creek Limestone exposed to the south of Moore Creek, and also included faunas from the "Woolomol Limestone" to the west and the "Spring Creek Limestone" further south (Fig. 1). Nine rugose coral species, including *Australophyllum giganteum* (Etheridge, 1899), *Carlinastraea halysitoides* (Etheridge, 1918), *Campophyllum?* sp. cf. *lindstromi* (Frech, 1886), *Disphyllum robustum* (Etheridge, 1899), *Mesophyllum cornubovis* (Etheridge, 1899), *Phacellophyllum porteri* (Etheridge, 1890), *Pseudomicroplasma australe* (Etheridge, 1892), *Sanidophyllum davidis* Etheridge, 1899, and *S. colligatum* (Etheridge, 1920) were recorded from the Moore Creek area, mainly

based on specimens collected by Ida Brown (Hill 1942). Hill suggested a Givetian age for the Moore Creek fauna and correlated it with a fauna from the Burdekin Formation of north Queensland.

In a recent revision of tabulate corals from the Moore Creek Limestone, Brühl and Pohler (1999) recorded seven species including *Heliolites porosus* (Goldfuss, 1826), *Thamnopora crumneri* (Etheridge, 1899), *Cladopora* sp., *Alveolites subordicularis* Lamarck, 1801, *A. sp. aff. hemisphericus* (Chernyshev, 1937), *Syringopora auloporoides* de Koninck, 1876 and *Remesia porteri* (Etheridge, 1899). Brühl and Pohler (1999) indicated a Middle Devonian age for the succession and demonstrated connections with coeval faunas in Eurasia.

Conodonts from the Moore Creek Limestone at Moore Creek suggested a late Eifelian (*kockelianus-ensensis* zones) age (Philip 1966, Mawson and Talent 1994, Mawson *et al.* 1997). However, samples from

nearby localities indicated that the top of the Moore Creek Limestone might extend into *hemiansatus* Zone and possibly early *varcus* Subzone of the early Givetian (Mawson and Talent 1997).

SYSTEMATIC PALAEONTOLOGY

Phylum COELENTERATA Frey and Leuckart, 1847
Subphylum CNIDARIA Hatschek, 1888
Class ANTHOZA Ehrenberg, 1834
Family STAURIIDAE Milne-Edwards and Haime, 1850

Genus *Loyolophyllum* Chapman, 1914

Synonym

Columnaria (*Loyolophyllum*) Chapman, 1914, p. 306.

Loyolophyllum Chapman; Hill, 1939, pp. 239–242.

Loyolophyllum Chapman; Hill, 1981, p. F135.

Type species

Columnaria (*Loyolophyllum*) *cresswelli* Chapman, 1914, pp. 306–8, pl. li, figs 15–16, pl. lii, figs 17–18; Early Devonian (late Lochkovian-Pragian), Loyola Limestone, Griffith's Quarry, Loyola, Victoria.

Diagnosis

Ceriod or phaceloid corallum; corallites small with narrow peripheral stereozone; septa few, thin, major septa unequal, some extending almost to axis; minor septa short; tabulae complete, commonly sagging, or horizontal; a few scattered dissepiments or presepiments adhering to wall by both upper and lower edges, or in some species an incomplete row of dissepiments may be developed (modified after Hill 1981, p. F135).

Remarks

The generic concept of *Loyolophyllum* is amended herein to restrict *L. (Loyolophyllum)* to ceriod forms and to establish a new subgenus, *L. (Fasciloyolophyllum)* for phaceloid forms. *Loyolophyllum (Fasciloyolophyllum)* differs from *Fasciphyllum* Schlüter, 1885 by having only isolated, rare occurrences of dissepiments or presepiments, which never form a continuous series of dissepiments as in *Fasciphyllum*. The type species of *Battersbyia* Milne-Edwards and Maime, 1851 is poorly understood. So *Battersbyia* is better treated as a *nomen dubium* and tentatively synonymised with *Fasciphyllum* (see Hill 1981).

The following four species are definitely assigned to *L. (Loyolophyllum)*:

Loyolophyllum cresswelli Chapman, 1914, p. 306; from the Loyola Limestone, Early Devonian, Victoria, Australia (ceriod form, corallites 1–1.13 mm [up to 2mm] in diameter, scattered presepiments).

Loyolophyllum cerioides Soshkina, 1949, p. 109; from Middle Devonian, Urals, Russia (ceriod form, corallites 4–7 mm in diameter, short septa in two orders 18–28x2, one discontinuous row of dissepiments occurring in longitudinal section, tabulae 7–11/10 mm).

Loyolophyllum urense Zhmaev in Khalfin, 1955, p. 217, pl. 36, fig. 6; from Devonian, W. Siberia, Russia (ceriod form, corallites 4.5 mm in diameter, septa in two orders 14–16x2, dissepiments sporadic, tabulae 10–16/10 mm).

Loyolophyllum isolatum Cao in Cao *et al.*, 1983, p. 136, pl. 45, fig. 4a–b; from Middle Devonian, Lurie Formation, Gansu, northwest China (ceriod form, corallites 2.5–3 mm in diameter, septa two orders 10x2, dissepiments rare, large and isolated, tabulae complete 14–18/10 mm).

The following two species are only tentatively included in *L. (Loyolophyllum)* pending further study of the type material:

Loyolophyllum praesepimentosum Flügel and Saleh, 1970, p. 285, pl. 4, figs 7–8; from Silurian, eastern Iran (ceriod form, corallite diameter 4.3–5.2 mm, tabulae 7–8/10 mm); and

Loyolophyllum savitskyi Wu, 1980, pp. 30–32, pl. 5, fig. 3a–b, from Lower Devonian, Uzbekistan (ceriod form, corallites 2–2.5 mm in diameter).

Excluded from *Loyolophyllum* are the following four species:

Loyolophyllum crevisseptatum Bulvanker 1958, p. 159; from Devonian, Russia (longitudinal sections show mural pores on the wall; hence this is a tabulate coral likely belonging to the Syringoporidae).

Loyolophyllum crassispinosum Tchernchev in Bulvanker *et al.*, 1960, p. 244, and

Loyolophyllum originale Bulvanker in Bulvanker *et al.*, 1960, p. 243, both from Givetian, Middle Devonian, Novaya Zemlya (both are ceriod species of Disphyllidae, close to *Spongonaria* or *Zelolasma*).

REVISION OF A DEVONIAN CORAL SPECIES

Loyolophyllum xizangense Yu and Liao, 1982, pp. 100, 101, pl., 2, figs 1–2, text-fig. 3; from Lower Devonian, northern Xizang, China (cerioid form, corallites 2.3–3 mm in diameter, tabulae 12–16/5 mm; 1–2 rows of steep dissepiments; by showing continuous series of dissepiments, it is here considered to represent a species of Spongophyllidae, likely belonging to *Spongophyllum*).

Loyolophyllum (Fasciloyolopyllum) subgen. nov.

Type species

Microplasma parallelum Etheridge, 1899, Middle Devonian (late Eifelian to early Givetian), from Moore Creek Limestone, near Tamworth, northeastern New South Wales.

Diagnosis

Like *Loyolophyllum (Loyolophyllum)*, but phaceloid.

Remarks

Apart from the type species *M. parallelum*, the following two species are assigned to *Loyolophyllum (Fasciloyolopyllum)*:

Fasciphyllum guizhouense Li in Kong and Huang, 1978, p. 124, pl. 40, fig. 6; Givetian, Middle Devonian, Dushan Formation, Guizhou, South China (phaceloid form, corallites 6–9 mm in diameter, septa in two orders 17–20x2, septal stereozone 0.7–1.2 mm in thickness, dissepiments elongated, in one discontinuous row, tabulae complete and concave).

Battersbyia qunlingensis Cao in Cao *et al.*, 1983, p. 137, pl. 46, fig. 7a–b; from Early Devonian, Gala Formation, Qinghai, northwest China (phaceloid form, corallites 2.5–3.7 mm in diameter, septa in two orders 12–14x2, septal stereozone 0.8–0.9 mm in thickness, nearly half of the corallite radius, dissepiments rare and isolated, semi-globose, tabulae concave).

Loyolophyllum (Fasciloyolopyllum) parallelum (Etheridge, 1899) (Figures 2, 3)

Synonymy

Microplasma parallelum Etheridge, 1899, p. 161, pl. 19, figs 1–2, pl. 30, figs 1–2; Fletcher, 1971, p.

31; Hill, 1978, p. 28.

Material

Holotype (monotypy): AM FT.3791(TS), AM FT.4063 (LS), AM FT.14149–14159 (LSs and TSs), all from AM F.35524 (original number: MMF843, M568; transferred from Geological and Mining Museum, Sydney in 1938), from Moore Creek Limestone, Middle Devonian (late Eifelian to early Givetian), near Tamworth, northeastern New South Wales.

Description

Phaceloid corallum, dome-shaped with dimensions of 15 cm in diameter and 13 cm in height; corallites slender, regular in size (Fig. 2J), 2.2 mm in average diameter, closely spaced and paralleling each other (Fig. 2K), and lateral increasing with corallites in contact or up to 5 mm apart at the peripheral part of the corallum.

Septa well developed, in two orders, 11–15x2 for adult corallites; peripherally dilated to form a narrow peripheral stereozone up to 0.45 mm in thickness, thin and weakly wavy in the tabularium, and with weakly developed carinae (Fig. 2C, F, I); trabecular structure obscured due to recrystallization; major septa long, reaching or nearly reaching axis, nearly radially extending (Fig. 2E); or unequal in length, in some weakly bisymmetrically arranged (Fig. 2A, C, F); minor septa variable in length, typically half to one-third of the corallite radius.

In longitudinal sections, dissepiments (or presepiments) sporadically developed, large and elongated (0.5 mm wide and 1.5 mm high), and vertically arranged with both ends attached to the wall, occasionally two or three overlapping each other (Fig. 3B, D). Tabulae complete, varying from horizontal (Fig. 3F) to deeply concave (Fig. 3C), and widely spaced, 4 to 5 per 2 mm vertically.

Discussion

The holotype of *L. (Fasciloyolopyllum) parallelum*, the sole known specimen, is partially silicified with internal structures obscured in most of the thin sections, and is heavily abraded without preservation of the proximal tip and the calices. For these reasons it has remained a poorly known species in the Devonian coral literature. Etheridge (1899) illustrated a longitudinal section showing concave, widely spaced tabulae and lateral budding, and a transverse section which lacks preservation of septal structure due to recrystallization. However, the well developed septa and complete tabulae as described and illustrated here from some better preserved corallites easily exclude this coral from the Order

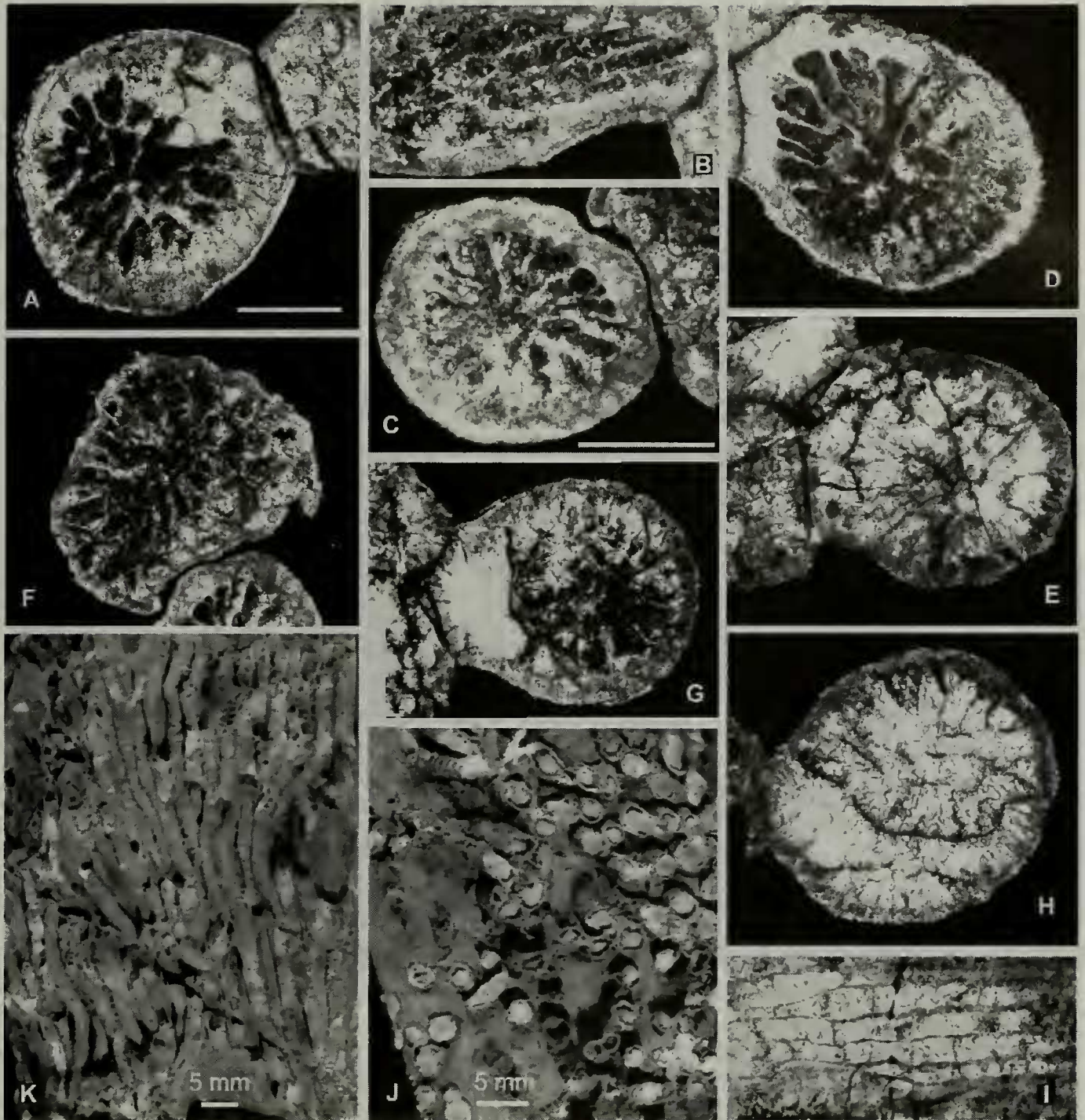


Figure 2. *Loyolophyllum* (*Fasciloyolophyllum*) *parallelum* (Etheridge, 1899). A, TS, a corallite from AM FT.14149; B, TanS, a corallite from AM FT.14150; C, TS, a corallite from AM FT.14149; D, TS, a corallite from AM FT.14149; E, TS, a corallite from AM FT.14151; F, TS, a corallite from AM FT.14149; G, TS, a corallite from AM FT.14151; H, TS, a corallite from AM FT.14153; I, TanS, from AM FT.4063; J, external upper view, AM F.35524; K, lateral external view, AM F.35524. A–B and D–I, x15 (see scale bar in A); C, x20; J, x1.5; K, x1; Scale bars 1 mm, unless otherwise indicated.

Cystiphyllida. Its slender corallites, well developed two orders of septa, complete tabulae, and in particular the sporadic, elongated dissepiments are comparable with those of *L. (Loyolophyllum) cresswelli* from the Early Devonian Loyola Limestone of Victoria, except that species is cerioid rather than phaceloid as in *L. (Fasciloyolophyllum) parallelum*.

L. (Fasciloyolophyllum) parallelum can be distinguished from *L. (Fasciloyolophyllum) guizhouense* (Li in Kong and Huang, 1978) in having smaller-sized corallites, fewer septa and a thinner septal stereozone, and from *L. (Fasciloyolophyllum) qunlingensis* (Cao in Cao et al., 1983) in having strongly elongated dissepiments or presepiments.

REVISION OF A DEVONIAN CORAL SPECIES

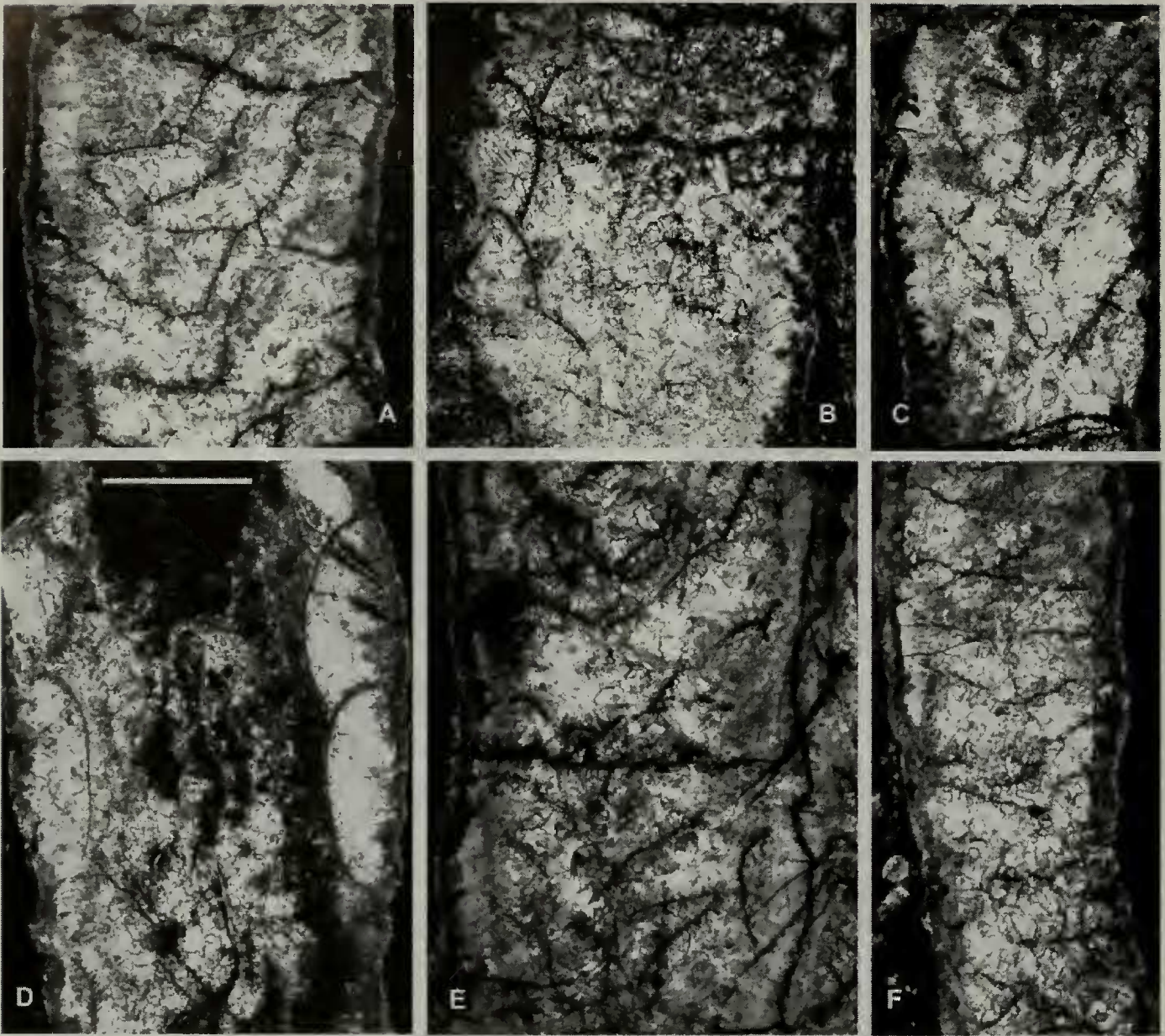


Figure 3. *Loyolophyllum* (*Fasciloyolophyllum*) *parallelum* (Etheridge, 1899). A, LS, a corallite from AM FT.4063; B, LS, a corallite from AM FT.4063; C, LS, a corallite from AM FT.14153; D, LS, a corallite from AM FT.14150; E, LS, a corallite form AM FT.4063; F, LS, a corallite from AM FT.4063; all x20. Scale bar 1mm.

constructive comments on the manuscript.

ACKNOWLEDGEMENTS

I thank Gary Dargan (Geological Survey of New South Wales) for preparation of additional thin sections of the holotype, Dr. Ian Graham (Mineralogy Section, Australian Museum) for assisting with digital photography, and Prof. Zhiyi Zhou for assistance in locating relevant Chinese and Russian literature at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences. Drs Ian Percival, Tony Wright and John Pickett provided

REFERENCES

- Benson, W. N. (1915). The geology and petrology of the Great Serpentine Belt of New South Wales. Appendix to Part V. The geology of the Tamworth district. *Proceedings of the Linnean Society of New South Wales* **40**, 540–624.
- Brown, I. A. (1942). The Tamworth Series (Lower and Middle Devonian) near Attunga, NSW. *Journal and*

- Proceedings of the Royal Society of New South Wales* 76, 166–176.
- Brühl, D. and Pohler, M. L. (1999). Tabulate corals from the Moore Creek Limestone (Middle Devonian: late Eifelian-early Givetian) in the Tamworth Belt (New South Wales, Australia). In R. Feist, J.A. Talent and A. Daurer (eds), North Gondwana: Mid-Paleozoic Terranes, Stratigraphy and Biota. *Abhandlungen der Geologischen Bundesanstalt* 54, 275–293.
- Bulvanker, E. Z. (1958). Devonskie chetyrekhluhevye korally okrain Kuznetskogo basseyna: 2 vol., 212pp., 93pls, Vses. Nauchno-issled. Geol. Inst. (Leningrad). (in Russian)
- Bulvanker, E. Z., Vasilyuk, N. P., Zheltonogova, V. A., Zhizhina, M. S., Nikolaeva, T. V., Spasskiy, N. Ya. and Shchukina, V. Ya. (1960). Novye predstaviteli chetyrekhluhevyykh korallorov SSSR. In B. P. Markovskiy (ed.), Novye vidy drevnikh rasteniy i bespozvonochnykh SSR, 1 (1), 220–254. (in Russian)
- Cao, X. D., Ouyang, X., Jin, T. A. and Cai, Z. J. (1983). Rugosa. In Xi'an Institute of Geology & Mineral Resources, Xibei diqu gushengwu tuce: Shaan-Gan-Ning fence [Palaeontological atlas of northwest China. Shaanxi-Gansu-Ningxia Volume]. Part 2, Upper Palaeozoic. 46–179, Geological Publishing House, Beijing. (in Chinese)
- Chapman, F. (1914). Newer Silurian fossils of eastern Victoria, part 3. *Records of Geological Survey of Victoria* 3, 301–316.
- Chernyshev, B. B. (1937). Siluriyskie i devonskie Tabulata Mongolii i Tuvy. *Akademiya Nauk SSSR. Trudy Mongolskii Komissii* 30, 5–34.
- Crook, K. A. W. (1961). Stratigraphy of the Tamworth Group (Early and Middle Devonian). Tamworth-Nundle District, N.S.W. *Journal and Proceedings of the Royal Society of New South Wales* 94, 173–188.
- Ehrenberg, C. G. (1834). Beiträge zur physiologischen Kenntniss der Corallenthiere im allgemeinen und besonders des Rothen Meeres, nebst einem Versuche zur physiologischen Systematik derselben. *Physiologische Abhandlungen der Königl. Akademie der Wissenschaft, Berlin* (1832), p. 225–380.
- Etheridge, R. Jr. (1890). On the occurrence of the genus *Tryplasma* Lonsdale (*Pholidophyllum* Lindström) and another coral apparently referable to *Diphyphyllum* Lonsdale, in the Upper Silurian and Devonian rocks respectively of New South Wales. *Records of the Geological Survey of New South Wales* 2, 15–21.
- Etheridge, R. Jr. (1892). Class Actinozoa. In R. L. Jack and R. Jr. Etheridge, Geology and palaeontology of Queensland and New Guinea. *Publications of Geological Survey of Queensland* 92, 50–64, 200–201.
- Etheridge, R. Jr. (1899). On the corals of the Tamworth district, chiefly from the Moore Creek and Woolomol Limestones. *Records of the Geological Survey of New South Wales* 6, 151–182.
- Etheridge, R. Jr. (1918). Two remarkable corals from the Devonian of New South Wales (*Spongophyllum halysitoides* and *Columnaria neminghensis*). *Records of the Australian Museum* 12, 49–51.
- Etheridge, R. Jr. (1920). Further additions to the coral fauna of the Devonian and Silurian of New South Wales (*Endophyllum schlueteri* var. *colligatum*, *Columnopora* (*Gephyropora*) *duni*, *Vepresiphyllum falciforme* and *Syringopora trupanonoides*). *Records of the Geological Survey of New South Wales* 9, 55–63.
- Etheridge, R. Jr. and Foord, A. H. (1884). On two species of *Alveolites* and one of *Amplexopora* from the Devonian rocks of northern Queensland. *Annals and Magazine of Natural History* (ser. 5) 14, 175–179.
- Fletcher, H. O. (1971). Catalogue of type specimens of fossils in the Australian Museum, Sydney. *The Australian Museum Memoir* 13, 1–167.
- Flügel, H. W. and Saleh, H. (1970). Die paläozoischen Korallenfaunen Ost-Irans 1 - Rugose Korallen der Niur-Formation (Silur). *Jahrbuch der Geologischen Bundesanstalt* 113, 267–302.
- Frey, H. and Leuckart, C. G. F. R. (1847). Beiträge zur Kenntniss wirbelloser Thiere mit besonderer Berücksichtigung der Fauna des Norddeutschen Meeres. viii+170p., 2pls, Verlag von Friedrich Vieweg und Sohn (Braunschweig).
- Goldfuss, G. A. (1862). Petrefacta Germaniae. Erster Theil. 12 S + 1–252, Taf. 1–71, Arnz, Düsseldorf 1826-1833, 2. Auflage iv + 1–134, Leipzig.
- Hatschek, B. (1888–1891). Lehrbuch der Zoologie, eine morphologische Übersicht des Thierreiches zur Einführung in das Studium dieser Wissenschaft: Lief. 1–3, iv + 432p., 407 text-fig., Gustav Fischer (Jena).
- Hill, D. (1939). The Devonian rugose corals of Lilydale and Loyola, Victoria. *Proceedings of the Royal Society of Victoria* 51, 219–256.
- Hill, D. (1942). The Devonian rugose corals of the Tamworth District, N.S.W. *Journal and Proceedings of the Royal Society of New South Wales* 76, 142–164.
- Hill, D. (1978). Bibliography and index of Australian Palaeozoic corals. *Papers, Department of Geology, University of Queensland* 8, 1–38.
- Hill, D. (1981). Rugosa and Tabulata. In C. Teichert (ed.), Treatise on Invertebrate Paleontology, Part F, Coelenterata, Suppl. 1. F1–762, Geological Society of America and University of Kansas (New York and Lawrence).
- Jia, H. Z., Xu, S. Y., Kuang, G. D., Zhang, B. F., Zou, Z. B. and Wu, J. S. (1977). Anthozoa. In Hubei Province Institute of Geology (ed.), Zhongnan diqu gushengwu tuce [Palaeontological atlas of central southern China]. Volume 2, Wan gusheng dai bufen [Late Palaeozoic Era]. 109–272, Geological Publishing House (Beijing). (in Chinese)
- Khalifin, L. L. (1955). Atlas of the leading forms of the fossil fauna & flora of western Siberia. Moscow, 21–26, 153–154, 185–191, 212–213. (in Russian)
- Kong, L. and Huang, Y. M. (1978). Tetracoralla. In Guizhou Stratigraphy and Palaeontology Work Team (ed.), Xinan diqu gushengwu tuce [Palaeontological

REVISION OF A DEVONIAN CORAL SPECIES

- atlas of southwest China]: Guizhou, Volume 1, Cambrian-Devonian. 35–161, Geological Publishing House (Beijing). (in Chinese).
- Koninck, L. G. de (1876-7). Recherches sur les fossiles paléozoïques de la Nouvelle-Galles du Sud (Australie). 373p., Atlas pls i-iv, 1876; pls v-xxiv, 1877, Bruxelles.
- Lamarck, J. B. P. A. de M. (1801). Système des Animaux sans Vertébrés, – viii + 432 p., published by the author, Paris.
- Mawson, R. and Talent, J. A. (1994). The Tamworth Group (mid-Devonian) at Attunga, New South Wales – conodont data and inferred ages. *Courier Forschungsinstitut Senckenberg* **168**, 37–58.
- Mawson, R., Pang, D. and Talent, J. A. (1997). G.J. Hinde's (1899) Devonian radiolarians from Tamworth, north-eastern New South Wales: stratigraphic and chronologic context. *Proceedings of the Royal Society of Victoria* **109**, 233–256.
- Milne-Edwards, H. and Haime, J. (1850–1855). A monograph of the British fossil corals: p. 1–299, pls 1–72. Palaeontographical Society Monograph (London).
- Orbigny, A. d' (1850). Prodrome de paléontologie stratigraphique universelle des animaux mollusques et rayonnés. V. 1, lx + 349p., Victor Masson (Paris).
- Pedder, A. (1967). The Devonian System of New England, New South Wales, Australia. In D.H. Oswald (ed.), International Symposium on the Devonian System, Calgary, 1967. Volume 2. 135–142, Alberta Society of Petroleum Geologists (Calgary, Alberta).
- Philip, G. (1966). Middle Devonian conodonts from the Moore Creek Limestone, northern New South Wales. *Journal and Proceedings of the Royal Society of New South Wales* **100**, 151–161.
- Pickett, J. (2002). Ozcorals: a bibliography and index of fossil corals from Antarctica, Australia, New Guinea and New Zealand. Version 2. <http://www.es.mq.edu.au/MUCEP/aap/downloads.htm>
- Schlüter, C. (1885). Dünnschliffe von Zoantharia rugosa, Zoantharia tabulata und Stromatoporidae aus dem paläontologischen Museum der Universität Bonn, Aussteller Professor Dr. C. Schlüter in Bonn. 52–56, Catalogue de l'Exposition géologique, Congrès géol. Int. 3rd sess. (Berlin).
- Soshkina, E. D. (1949). Devonskie korally Rugosa Urala. *Trudy Paleontologicheskogo Instituta. Akademiya Nauk SSSR* **15** (4), 1–162. (in Russian)
- Soshkina, E. D. (1954). Devonski chetyrekhlučevye korally Russkoy platformy [Devonian tetra-
radiate corals of the Russian Platform]. *Trudy Paleontologicheskogo Instituta. Akademiya Nauk SSSR* **52**, 1–76, pls 1–19. (in Russian)
- Wu, D.L. (1980). New species of rugose corals from the Upper Silurian and Devonian of northeastern Fergana. *Paleontologicheskii Zhurnal* **1980** (3), 28–33. (in Russian)
- Yu, C. M. and Liao, W. H. (1982). Discovery of Early Devonian tetracorals from Xainza, northern Xizang (Tibet). *Acta Palaeontologica Sinica* **21** (1), 96–107.